

On the effects of temperature in the larval stage to the adult external characters of *Fixsenia iyonis surugaensis* (Fujioka) (Lepidoptera, Lycaenidae)

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Abstract The larvae of *Fixsenia iyonis surugaensis* were reared at 15°C and 25°C respectively. After emergence of the adults, lengths of the forewing, hindwing and tail were measured and compared between the specimens reared at 15°C and 25°C. Compared with those of the adults reared at 25°C, the forewing and hindwing lengths of the adults reared at 15°C were longer on average. On the other hand, the tail length was much shorter in the adults reared at 15°C than at 25°C. It is probable that the tail length of the adult *F. i. surugaensis* is due to the rearing temperature in the larval stage.

Key words Lycaenidae, *Fixsenia iyonis surugaensis*, temperature in larval stage, wing length, tail length.

Fixsenia iyonis (Ota & Kusunoki), which is known from Japan and continental China, shows a sporadic distribution and is divided into 6 subspecies, of which 4 are distributed in the western part of Honshu and Shikoku of Japan (Inomata, 1990).

In 1996 Ohgane noticed a difference in the tail length of the hindwing between the adults of *Fixsenia iyonis surugaensis* (Fujioka) reared at room temperature and at 25°C, respectively. In the next spring we reared this subspecies again under two temperature conditions of 15°C and 25°C until emergence of the adults, and measured the forewing, hindwing and tail lengths of the adults. As a result of measurements we recognized the relation between the rearing temperature in the larval stage and the tail length of the hindwing, and therefore we report as follows.

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Materials and methods

The eggs of *Fixsenia iyonis surugaensis* (Fujioka) used here were collected at Kamishima, Minami-shinano-mura, Nagano Pref. in autumn, 1996 and were preserved in the freezer until the next spring.

First instar larvae hatched in a day or two were used in this study. The larvae were reared in plastic cases (length about 16 cm, width about 27 cm and height about 19 cm) with the host plant, *Rhamnus japonica* Maxim. (Rhamnaceae), at 15°C and 25°C with a photoperiod 16L-8D until the emergence of adults. 25 larvae were reared under each temperature

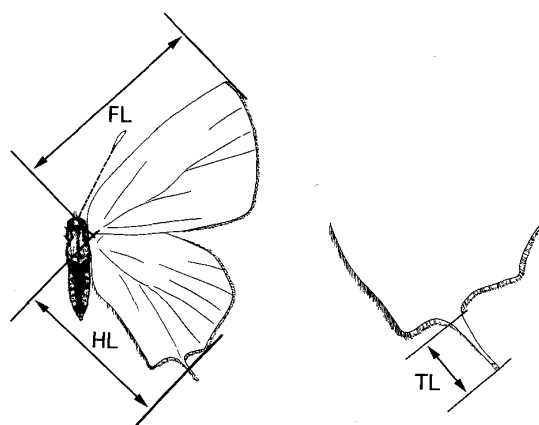


Fig. 1. Measurement of the adult *Fixsenia iyonis surugaensis* (FL: forewing length, HL: hindwing length, TL: tail length).

condition. Of the larvae reared at 15°C, 4 individuals (2 ♂ 2 ♀) were treated at 25°C after pupation. After emergence of the adults, lengths of the forewing, hindwing and tail were measured as in Fig. 1.

Results and discussion

Lengths of the forewing, hindwing and tail

The number of adults reared was 11 males and 11 females (including 2 males and 2 females treated at 25°C after pupation) at 15°C, and was 12 males and 10 females at 25°C. Table 1 shows measurements of the forewing, hindwing and tail lengths. There was no difference in the forewing, hindwing and tail lengths between the individuals reared at 15°C during all stages and those treated at 25°C after pupation. Compared with those of the adults reared at 25°C, the forewing and hindwing lengths of the adults reared at 15°C were longer on average. However, the tail length was much longer in the specimens reared at 25°C than at 15°C (Fig. 2).

That the lengths of the forewing and hindwing are longer on average under the condition of 15°C seems to be related to the larval period, because the larval period reared at 15°C was approximately 30 days longer than at 25°C.

Nishimura (1981) indicated that the hindwing tail of *F. iyonis surugaensis* shows a continuous variation from the short tail like that of *F. i. küiensis* to the long one like that of *F. i. kibiensis*, but the values of the tail length were not shown. On the other hand, Nanba (1988:

Table 1. Measurements of adults of *Fixsenia iyonis surugaensis*.

Sex	Temp.	No. adults	Forewing length (mm)			Hindwing length (mm)			Tail length (mm)		
			Min.	Max.	Mean±SD	Min.	Max.	Mean±SD	Min.	Max.	Mean±SD
♂	15°C	11	15.1	16.3	15.6±0.4	12.2	13.3	12.7±0.4	1.0	1.6	1.3±0.2
	25°C	12	14.4	15.5	15.0±0.3 ¹⁾	12.0	12.6	12.3±0.2	1.7	2.2	1.9±0.1
♀	15°C	11	17.5	19.5	18.3±0.6	13.8	15.9	15.2±0.6	1.7	2.4	1.9±0.2
	25°C	10	16.5	17.8	17.0±0.4	13.5	14.8	14.1±0.4	2.5	3.0	2.7±0.2

¹⁾ Of twelve males, two could not be measured.

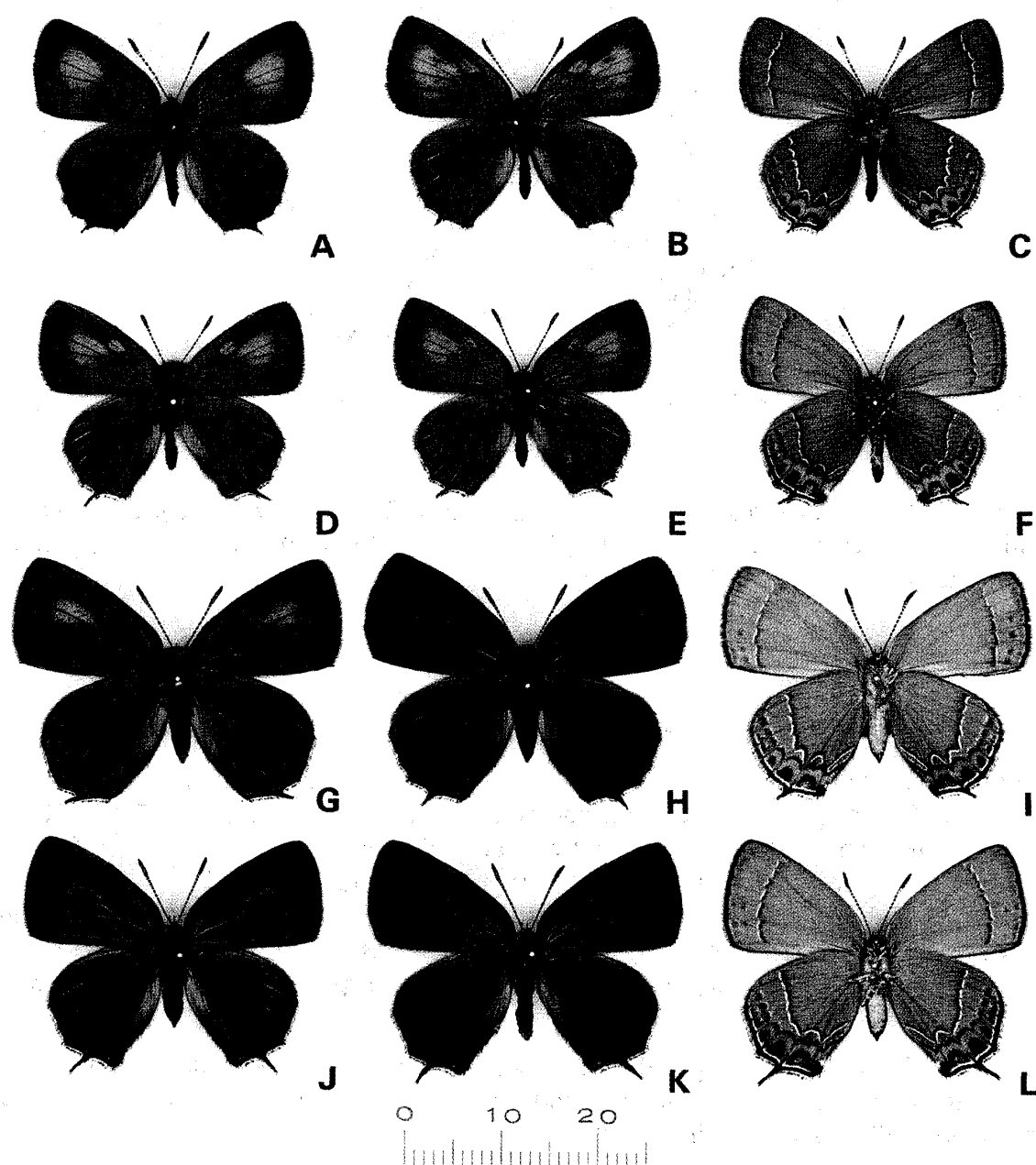


Fig. 2. *Fixsenia iyonis surugaensis* (A-C: males reared at 15°C, D-F: males reared at 25°C, G-I: females reared at 15°C, J-L: females reared at 25°C).

table 6) presented the values of the tail length in each of the geographical races for comparison. According to Nanba (1988), the tail length of *F. i. surugaensis* is the second longest among the Japanese subspecies, but shows a wide variation. However, the tail length of *F. i. surugaensis* reared at 25°C in this study was the longest among the Japanese subspecies, and that of the specimens reared at 15°C was rather short and almost the same as those of *F. i. kiiensis* and the Kochi and Tokushima populations in the nominotypical subspecies. There were no relations between the forewing and tail lengths, and between the hindwing and tail lengths (Figs 3, 4). Therefore, it is probable that the tail length is due to the rearing temperature in the larval stage in addition to genetic factors.

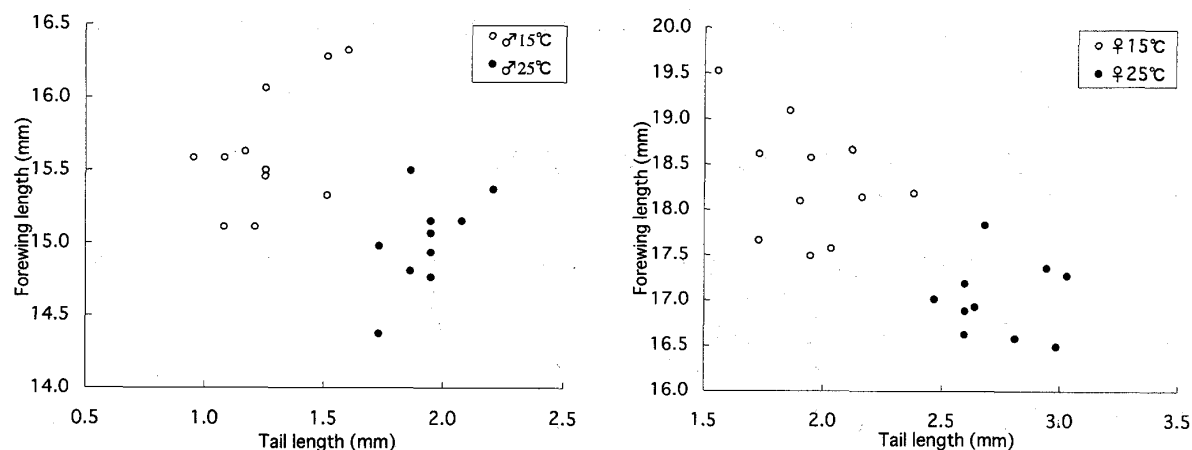


Fig. 3. Relationship of the forewing and tail lengths of *Fixsenia iyonis surugaensis*.

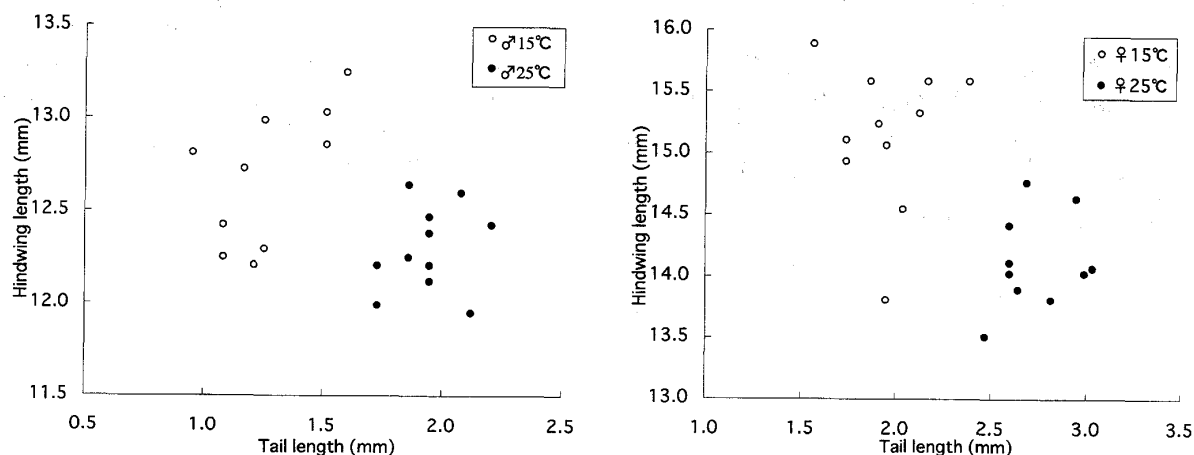


Fig. 4. Relationship of the hindwing and tail lengths of *Fixsenia iyonis surugaensis*.

Other characters

The hindwing margin was rather round in the specimens reared at 15°C, but slightly protruding on vein 3 (CuA_1) in those reared at 25°C (Fig. 2). There is an assumption that the hindwing tail of the subfamily Theclinae originates from the hindwing outer margin (Takasaki & Shinkawa, 1998). If we adopt this assumption on the morphogenetic origin of the hindwing tail, it is considered that the above characteristic is related to the tail length.

As to other characters including the white line on the under surface of the hindwing, which shows a wide variation in *F. i. surugaensis*, there was no difference between individuals reared at 15°C and 25°C.

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摘 要

幼虫期の温度条件がベニモンカラスシジミ長野静岡亜種の成虫に与える影響について (大鐘裕道・小野寺慎吾・橋本里志)

著者の一人、大鐘は1995年冬季に長野県南信濃村で採卵したベニモンカラスシジミ長野静岡亜種 *Fixsenia iyonis surugaensis* (Fujioka) を翌春飼育したところ、室温で飼育した個体と25°Cの恒温室で飼育した個体の間に尾状突起の長さに違いがあることに気づいた。そこで、翌1997年に同地で採卵した卵より孵化した幼虫を15°Cと25°Cの温度条件で飼育し、羽化した成虫を比較検討した。

前翅長と後翅長共に15°Cで飼育された個体が、25°Cで飼育された個体よりも相対的に大きい傾向にあった (Table 1, Figs 3, 4)。このことは、15°Cで飼育した幼虫期間が25°Cでの幼虫期間よりもおよそ30日間長かったことから、幼虫期間の長さに関係しているように思われる。

前翅長と後翅長とは逆に、尾状突起の長さは、25°Cで飼育された個体が15°Cで飼育された個体よりも有意に長かった。難波 (1988) によると、長野静岡亜種は日本産亜種の中では中国地方亜種に次いで尾状突起が長い、かなりの変異が見られると言う。今回、25°Cで飼育した個体は、中国地方亜種よりも尾状突起の長さは長かった。また、15°Cでは、紀伊半島亜種と原名亜種の徳島、高知個体群と同程度に短かった。以上のことから、少なくとも長野静岡亜種において、尾状突起の長さは遺伝的要因に加えて、幼虫期の温度条件によっても影響を受けることが推察された。

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